

# 1999 NGV Projects Reported to the U.S. 1605(b) Voluntary Reporting of Greenhouse Gases Program

Note: The following project reports were pulled from the 1605(b) database. For more information and detail on project descriptions and emission calculations, contact the Voluntary Reporting Program.

Project Developer: **Baltimore Gas & Electric Co.**

Project Name: Alternately Fueled Vehicles

Project Description:

Operation of various numbers of Alternately-Fueled Vehicles using Compressed Natural Gas.

Estimation Method:

CO<sub>2</sub> comparisons are based upon DOE data indicating that the CO<sub>2</sub> emission coefficient for gasoline is 156.7 pounds of CO<sub>2</sub> per million BTU and the coefficient for natural gas is 117.1 pounds of CO<sub>2</sub> per million BTU (DOE EIA-1605(1998)). Assumed vehicles travel 15,000 miles per year and gasoline has a heating value of 115,400 Btu/gallon in an automotive application. Motor- gasoline vehicles have a fuel efficiency of approximately 288 mi/mmBtu and CNG vehicles have a fuel efficiency of 218 mi/mmBtu. Emissions are claimed for the CNG fuel consumed and reductions are claimed for the displaced motor gasoline.

	1991	1992	1993	1994	1995	1996	1997	1998	1999
Project Size: Vehicles				184	184	184	188	178	161
Reported Reductions (Metric Tons CO <sub>2</sub> ):				151.3	151.3	151.3	154.6	146.4	132.4

Project Developer: **Central Hudson Gas & Electric Corporation.**

Project Name: Natural Gas Vehicles

Project Description:

In 1988, several company fleet vehicles were converted to operate on natural gas with the ability to operate on gasoline retained. These conversions cost approximately \$3,500 per vehicle. In addition, a 60cfm CNG station was constructed to refuel these vehicles. As the project continued, several more vehicles, mostly cars and light pick-up trucks, were converted, and new, factory built NGV's were also purchased. Presently, 18 vehicles, including 4 factory built NGV's purchased at a \$3,500 premium over the gasoline versions, are being operated on natural gas.

Estimation Method:

The meters located at the sole NGV refueling site, record both the amount of natural gas delivered, plus the gasoline gallon-equivalent (a roughly 8.415 gallons/1,000 cubic feet conversion). The CO<sub>2</sub> emission rate (from Appendix B in the Form EIA-1605 Instructions) for natural gas (120.593 lbs/Mcf) was used to estimate the emissions from the CNG vehicles. The reference case emissions were calculated from the gasoline equivalent of the natural gas consumed using the emission rate for motor gasoline (19.564 lbs/gal). The latter emissions represent the emissions that would have occurred if the vehicles had been operated with gasoline.

1999 CO<sub>2</sub> Reduction Calculation:

Natural Gas: 766.6 Mcf (1999) x 120.593 lbs CO<sub>2</sub>/MMBTU = 92,446.5938 lbs  
92,446.5938 lbs/2,000 lbs per short ton = 46.2233 tons

Gasoline: 6,450.94 gal displaced (1999) x 19.564 lbs CO<sub>2</sub>/MMBTU = 126,206.1906 lbs  
126,206.1906 lbs/2,000 lbs per short ton = 63.10310 tons

Reduction: 63.1021 tons - 46.2233 tons = 16.8798 CO<sub>2</sub> ton reduction

	1991	1992	1993	1994	1995	1996	1997	1998	1999
Project Size: Vehicles		12	12	19	19	19	19	19	18
Reported Reductions (Metric Tons CO <sub>2</sub> ):	7.5	4.8	13.1	15.0	14.2	9.5	13.5	16.2	15.3

Project Developer: **City of Palo Alto**

Project Name: City fleet conversion to CNG

### Project Description:

City fleet conversion to CNG: Total annual miles =168,040.

Total annual fuel = 17,566 therms.

Estimation Method:

City fleet conversion to CNG: Total annual miles =168,040.

Total annual fuel = 17,566 therms. Comparison made to average fleet car with 13 miles/gallon. Gallons saved are gross gallons saved, but CO<sub>2</sub> emission reduction is net of the CO<sub>2</sub> added by burning natural gas. Assumptions for Conversion to CO<sub>2</sub>: 19.6 lbs/gallon of motor gasoline

[illegible]

Project Developer: **City Utilities of Springfield**

Project Name: Natural Gas Fleet

Project Description:

City Utilities purchased one compressed natural gas service van for the use of our Telecommunications Department. In addition we installed a fueling station for this vehicle and others like it that we or others in our service territory may choose to purchase later. The van prominently advertises that it is an alternate fuel vehicle as it makes service calls throughout the territory.

City Utilities has previously indicated an intent to purchase one or more electric vehicles for this same purpose. The EV option is being reevaluated pending advancements in that technology and implementation in other parts of the country. In the meantime, the CNG alternate fuel vehicle will help introduce our constituents to alternate fuel options.

Estimation Method:

The emissions are all due to the natural gas burned at an emission rate of 120.593 lb CO<sub>2</sub> / Mscf.

The emission reduction is the difference between the gasoline that would have been emitted at 19.641 lb CO<sub>2</sub> / gal and the natural gas actually emitted.

	1991	1992	1993	1994	1995	1996	1997	1998	1999
Project Size: Vehicles					1	1	1	1	1
Reported Reductions (Metric Tons CO <sub>2</sub> ):					0.8	0.7	1.1	0.7	0.5

Project Developer: **Delmarva Power**

Project Name: CNG Vehicles

Project Description:

Vehicles run on compressed natural gas (CNG) instead of gasoline. Beginning 1995, external fleets will also operate on natural gas. However, reductions reported in Part III reflect Delmarva Power's vehicles only.

Estimation Method:

For 1999:

$$\text{CO}_2 \text{ (tpy)} = \# \text{ CNG vehicles} \times (12,504 \text{ miles/yr}) / (24 \text{ miles/gallon}) \times [19.6 \text{ lb CO}_2/\text{gal gasoline} - (120.6 \text{ lb CO}_2/\text{mscf NG} \times 0.127 \text{ mscf NG/gal gasoline})] / 2000 \text{ lbs/st}$$

	1991	1992	1993	1994	1995	1996	1997	1998	1999
Project Size: Vehicles	5	11	21	31	28	43	37	36	31
Reported Reductions (Metric Tons CO <sub>2</sub> ):	7.3	16.3	30.8	45.4	40.8	62.6	53.5	52.6	31.8

Project Developer: **Dynegy Midwest Generation Inc.**

Project Name: CNG Vehicle Conversions

Project Description:

Since late 1992, Illinois Power has converted company-owned vehicles and work equipment to operate on compressed natural gas. Vehicles converted to CNG include passenger cars, light trucks, heavy-duty trucks and forklifts.

The volume of CNG consumed is listed in #4 above, as gallons. This is actually "gasoline gallon equivalent," or 5.66 lb of natural gas.

Estimation Method:

Total emissions were estimated by the difference between the emissions that would have resulted from the gasoline displaced, and from the emissions which resulted from the use of CNG. Actual gallons of CNG used by each vehicle type were multiplied by the fuel efficiency for each vehicle type to determine the mileage driven. The following assumptions were used for mileage estimates: cars 25 mpg, light duty trucks 15 mpg, and heavy duty trucks and forklifts 5 mpg. Gallons of CNG to gasoline equivalent were based on equal Btu values (125,000 Btu/gal). Emission factors for miles driven and for each fuel type were from Tables 4.2 and 4.3 in Vol. II of the "Guidelines" for reporting. Annual emissions were determined as follows:

Annual emissions=mileage x E factor per mile + fuel use x E factor per unit of fuel

Annual emissions were calculated for gasoline and for CNG and divided into direct and indirect emissions using 85% direct for gasoline and 81% direct for CNG. The difference from projected gasoline emissions and CNG emissions were reported as reductions.

\* Previous years reductions were updated in 1996 to reflect the above assumptions and emission factors.

	1991	1992	1993	1994	1995	1996	1997	1998	1999
Project Size: Vehicles			25	30	34	32	32	32	24
Reported Reductions (Metric Tons CO <sub>2</sub> ):	0.0	0.0	54.6	42.1	47.5	45.0	29.6	17.9	14.8

Project Developer: **Entergy Services, Inc.**  
Project Name: Natural Gas Vehicle Program  
Project Description:

The natural gas vehicles program began in Baton Rouge, La in 1981 and in New Orleans, LA in 1993.

Estimation Method:

The net CO<sub>2</sub> reductions from using natural gas instead of gasoline to fuel vehicles was calculated as follows:

CO<sub>2</sub> Emissions decreased (tons) = gasoline displaced (gallons) x 19.564 lbCO<sub>2</sub>/gal x 1/2000 tons/lbs

CO<sub>2</sub> emission increase from use of natural gas(tons) = natural gas used (Mscf) x 120.593 lbCO<sub>2</sub>/Mscf x 1/2000 tons/lb

Net CO<sub>2</sub> reductions = CO<sub>2</sub> Emissions decrease - CO<sub>2</sub> Emissions increase

	1991	1992	1993	1994	1995	1996	1997	1998	1999
Project Size: Vehicles	40	40	40	50	53	53	63	63	63
Reported Reductions (Metric Tons CO <sub>2</sub> ):	123.4	123.4	123.4	115.2	83.5	70.8	118.8	100.7	78.9

Project Developer: **Niagara Mohawk Power Corporation**

Project Name: Alternative Fuel Vehicles

Project Description:

NMPC has been involved in operating and testing alternative fuel vehicles (AFVs) for almost 30 years. The Company also currently has a number of "Clean Air" natural gas-fueled buses in operation as part of a cooperative program with the Syracuse, New York Centro transit system.

Estimation Method:

CO<sub>2</sub> emission reductions are based on the difference in CO<sub>2</sub> emissions between gasoline-fueled vehicles and CNG or electric vehicles. Only direct emission reductions are reported. Emissions estimates are based on a CO<sub>2</sub> emission factor for each fuel. For motor gasoline, an emission factor of 19.641 lbs/gallon was used. For diesel fuel, an emission factor of 22.384 lbs/gallon was used. For CNG vehicles, a factor of 120.593 lbs/Mcf was used. These factors are based upon Form EIA-1605, Voluntary Reporting of Greenhouse Gases, Instructions, Appendix B. Fuel and Energy Source Codes and Emission Coefficients: EIA, 1996. For electric vehicles, NYPPs marginal emissions rate of 1.44 lbs/kWh for the years 1991-1995, rate of 1.48 lbs/kWh for 1996, and 1.46 lbs/kWh for 1997 and 1998 were used. These marginal rates were determined based on production simulation modeling (PROMOD IV).

	1991	1992	1993	1994	1995	1996	1997	1998	1999
Project Size: Vehicles	9	11	19	24	52	50	44	37	28
Reported Reductions (Metric Tons CO <sub>2</sub> ):	1.9	4.3	10.8	12.6	28.2	24.3	22.6	20.1	16.6



Project Developer: **NiSource/NIPSCO**

Project Name: Natural Gas Vehicles

Project Description:

NIPSCO is committed to significantly increasing the percentage of NGVs in our fleet over the next several years through the following actions:

- 1) Purchasing factory-direct dedicated NGVs as available
- 2) Converting forklifts and light duty vehicles and trucks to compressed natural gas (CNG)
- 3) Utilizing liquefied natural gas (LNG) in our heavy-duty trucks.

In addition to utilizing natural gas in our own fleet, NIPSCO will increase the number of NGVs operating throughout our region by providing a highly reliable fueling infrastructure, and by developing strategic alliances with educational, governmental, and social organizations. NGV training and consulting services will be provided to meet the mandates of the Clean Air Act Amendments of 1990. NIPSCO has been a leader in NGVs since 1981. The NGV market is expected to increase (in accordance with mandates contained in the Energy Policy Act of 1992). Market demands and preferences will then drive the further proliferation of NGVs through the end of this century.

Estimation Method:

NIPSCO used the following data below in its calculations.

Assumptions: for 1994-1998

CNG fuel usage rate = 46,886,000 cf/569 vehicles = 82,400 cf/vehicle

HHV gasoline 125,000 BTU/gal

HHV Natural Gas = 1030 BTU/cu.ft

Conversion Factor from NG to gasoline = (125,000 BTU/gal gas)(1 cu.ft. NG/1030 BTU)(1 BTU NG/0.94 BTU gas)

Conversion Factor from NG to gasoline = 129.1 cu.ft. NG/gallon of gasoline

Emission factors:

NG = 0.1206 lbs CO<sub>2</sub>/cu.ft.

Gasoline = 19.64 lbs CO<sub>2</sub>/gallon

Calculations:

- |        |  |
|--------|--|
| Calc.1 | (Number of CNG vehicles) x 82,400 cf/vehicle = cu.ft. NG   |
| Calc.2 | (cu.ft. of CNG) / 129.1 cu. ft. NG/gallon of gasoline = equiv. gallons of gasoline                   |
| Calc.3 | (cu.ft. NG) x 0.1206 lbs CO <sub>2</sub> /cu.ft./2000 = tons CO <sub>2</sub> from NG                 |
| Calc.4 | (gallons of gasoline) x 19.641 lbs CO <sub>2</sub> /cu.ft./2000 = tons CO <sub>2</sub> from gasoline |
| Calc.5 | Difference between NG CO <sub>2</sub> and gasoline CO <sub>2</sub>                                   |

For 1999 NiSource implemented an automated fuel tracking system and was able to more accurately report the amount of GGE (Gallons of Gasoline Equivalent) used throughout our service territory.

Year	GGE	CO <sub>2</sub> Emissions (Tons)	CO <sub>2</sub> Reductions (Tons)
1999	242,888	1,772	604

1 GGE (gallon of Gasoline Equivalent) x 121 = cu ft NG

NG = 120.593 lbs CO<sub>2</sub>/1000 cu ft

1 GGE CO<sub>2</sub> emission rate = 1 GGE\*121\*120.593 lbs CO<sub>2</sub>/1000 cu ft = 14.59 lbs CO<sub>2</sub>/GGE

1 Gallon of Gasoline CO<sub>2</sub> emission rate = 19.564 lbs CO<sub>2</sub>/gallon gasoline

Savings = 19.564 - 14.59 = 4.974 lbs CO<sub>2</sub>/GGE

	1991	1992	1993	1994	1995	1996	1997	1998	1999
Project Size: Vehicles		704	645	569	610	630	599	607	618
Reported Reductions (Metric Tons CO <sub>2</sub> ):	818.3	820.1	752.1	663.2	711.2	733.9	698.5	707.6	550.7

Project Developer: **PG&E Corporation**

Project Name: Natural Gas Vehicles

Project Description:

Pacific Gas and Electric Company Clean Air Vehicle Program: In 1990 Pacific Gas and Electric Company received California Public Utility Commission approval to spend up to \$50 million by December 31, 1994 to support the development and introduction of electric and natural gas vehicles. By the end of 1993, Pacific Gas and Electric Company was operating 698 natural gas vehicles and 30 natural gas refueling stations. Encouragement took many forms: demonstrating vehicle and station performance, providing natural gas refueling station designs, providing partial funding for vehicle purchases, opening Company stations for public use, etc. After 1994, there was a decreased emphasis on customer financial support. But Pacific Gas and Electric Company has continued to promote, facilitate and encourage electric and natural gas vehicle use by its customers. Pacific Gas and Electric Company continues to claim credit for not only its own fuel displacement, but also for displacements that it has encouraged its customers to undertake.

Estimation Method:

Natural gas therms used by natural gas vehicles is estimated from meter records of natural gas delivered by Pacific Gas and Electric Company to its own natural gas vehicle refueling stations, and of the natural gas supplied to customer owned natural gas refueling stations within its service territory. Pacific Gas and Electric Company takes credit for natural gas savings by customers within the Company's northern and central California service territory because Pacific Gas and Electric Company ratepayers funded a comprehensive program to promote natural gas use in vehicles, which program included both financial and technical support for numerous customer stations. Using the following factors, the Company calculates CO<sub>2</sub> emissions and emissions avoided through displaced gasoline:

103,001 mmBtu per million therms

1.1 therms per equivalent gallon of gasoline

117.08 lbs. CO<sub>2</sub> per mmBtu natural gas

19.564 lbs. CO<sub>2</sub> per gallon of gasoline

In 1999 a total of 7.065 million therms of natural gas were used to displace gasoline.

62,827 tons CO<sub>2</sub> gasoline - 42,599 tons CO<sub>2</sub> natural gas = 20,228 tons CO<sub>2</sub> avoided.

	1991	1992	1993	1994	1995	1996	1997	1998	1999
Project Size: Vehicles				698	873	820	828	696	633
Reported Reductions (Metric Tons CO <sub>2</sub> ):				7,455.2	9,667.0	12,293.3	15,648.0	16,623.3	18,350.5

Project Developer: **Portland General Electric Co.**

Project Name: Natural Gas Fleet Vehicles

Project Description:

These are fleet vehicles voluntarily converted to natural gas. They operate in PGE's service area and commute to generation facilities. This area is the northern Willamette Valley and Columbia River gorge.

Estimation Method:

We know that 2 vehicles were converted in 1993 and 4 additional vehicles were converted in 1994. Fifteen more natural gas vehicles were delivered in mid-year (June) 1997. In 1998 eight 1/2 ton pickups were converted allow natural gas as a fuel in mid-year 1998. In 1999, another ten 1/2 ton pickups were converted to allow natural gas as a fuel in mid year 1999. We assume the fleet vehicles travel 8000 mi/year each, that the gasoline mileage is 20 mi/gal, and that each gasoline vehicle emits 7838 pounds of CO<sub>2</sub> per year and each NG vehicle emits 4752 pounds per year. Fuel use for the NG vehicle was estimated using a conversion of 118 pounds of CO<sub>2</sub> per MBTU of energy.

	1991	1992	1993	1994	1995	1996	1997	1998	1999
Project Size: Vehicle Miles Traveled			16,000	48,000	48,000	48,000	108,000	200,000	272,000
Reported Reductions (Metric Tons CO <sub>2</sub> ):			2.8	8.4	8.4	8.4	18.9	35.0	47.6

Project Developer: **Public Service Company of New Mexico**

Project Name: CNG Vehicles

Project Description:

PNM has been increasing the use of CNG vehicles in its fleet, particularly for its cars and small trucks and vans. In the twelve-month period ending 6/30/97, PNM vehicles logged nearly 24 million miles. Of this amount, CNG-capable vehicles logged 4,082,778 miles, of which approximately 90% of these miles were fueled by CNG (the balance were fueled by unleaded gasoline as the vehicles are dual fueled). Since CNG is a lower carbon fuel than is gasoline, approximately 40 pounds of CO<sub>2</sub> are saved for each MMBtu of gasoline displaced. This is based on emission factors of 157.041 lbs CO<sub>2</sub>/MMBtu for motor gasoline and 117.080 lbs CO<sub>2</sub>/MMBtu for natural gas.

**1997:**

In the period 7/1/97 through 5/31/98, PNM fleet vehicles logged approximately 13 million miles. Of this amount, CNG-capable vehicles logged 1,964,763 miles of which approximately 75% of these miles were fueled by CNG (the balance were fueled by unleaded gasoline as the vehicles are dual fueled). Since CNG is a lower carbon fuel than gasoline, approximately 41.4 pounds of CO<sub>2</sub> are not released for each MMBtu of gasoline displaced. This is based on emission factors of 156.662 lb CO<sub>2</sub>/MMBtu for motor gasoline and 115.258 lb CO<sub>2</sub>/MMBtu for natural gas (1998 Instructions for Form EIA-1605, Appendix B).

**1998:**

Since the last reporting period, PNM fleet vehicles logged approximately 11.9 million miles. Of this amount, CNG-capable vehicles logged 1,355,833 miles. Since CNG is a lower carbon fuel than gasoline, approximately 41.167 pounds of CO<sub>2</sub> are not released for each MMBTU of gasoline displaced. This is based on emission factors of 156.425 lb CO<sub>2</sub>/MMBTU for motor gasoline and 115.258 lb CO<sub>2</sub>/MMBTU for natural gas (1999 Instructions for Form EIA -1605, Appendix B).

**1999:**

Data not available

Estimation Method:

**1996**

The CO<sub>2</sub> savings of using the CNG vehicles were estimated as follows:

- 4,082,778 miles in CNG vehicles x 90% of those miles are CNG fueled = 3,674,500 CNG miles
- 3,674,500 CNG miles / 12 miles per gallon equivalent = 306,208.33 gallons equivalent of CNG used
- 306,208.33 gallons equivalent of CNG used / 8.08 gallons of gasoline per MMBtu (5.2 MMBtu/bbl.gasoline)= 37,897.071 MMBtu of CNG used
- 37,897.071 MMBtu of CNG used x 40 lbs.CO<sub>2</sub> saved per MMBtu of CNG used instead of gasoline = 1,515,883 lbs. of CO<sub>2</sub> saved
- 1,515,883 lbs. of CO<sub>2</sub> saved / 2000 lbs. per ton = 757.941 tons of CO<sub>2</sub> saved

**1997**

The CO<sub>2</sub> savings are estimated as follows:

- 1964763 miles in CNG vehicles x 75% of those miles CNG-fueled = 1,473,572 CNG miles
- 1,473,572 CNG miles / 12 miles per gallon equivalent = 122,798 gallons equivalent of CNG used
- 122,798 gallons equivalent of CNG used / 8.08 gallons per MMBtu = 15,198 MMBtu of CNG used
- 15,198 MMBtu of CNG used x 41.4 lb CO<sub>2</sub> saved per MMBtu (see note below) = 629,197 lb of CO<sub>2</sub> not emitted
- 629,197 lb of CO<sub>2</sub> not emitted / 2000 = 314.6 tons CO<sub>2</sub> not emitted

NOTE: MG = 156.662 lb CO<sub>2</sub>/MMBtu

CH<sub>4</sub> = 115.258 lb CO<sub>2</sub>/MMBtu

MG-CH<sub>4</sub> = 41.4 lb CO<sub>2</sub>/MMBtu

**1998**

The CO<sub>2</sub> savings are estimated as follows:

- 1,355,833 miles in CNG vehicles / 12 miles per gallon equivalent = 112,986 gallons equivalent of CNG used
- 112,986 gallons equivalent of CNG used / 8.08 gallons per MMBtu = 13,983 MMBTU of CNG used
- 13,983 MMBTU of CNG used x 41.167 lb CO<sub>2</sub> saved per MMBTU (see note below) = 575,638 lb CO<sub>2</sub> not emitted
- 575,638 lb CO<sub>2</sub> not emitted / 2000 = 287.8 tons of CO<sub>2</sub> not emitted

NOTE: MG = 156.425 lb CO<sub>2</sub>/MMBTU

CH<sub>4</sub> = 115.258 lb CO<sub>2</sub>/MMBTU

MG-CH<sub>4</sub> = 41.167 lb CO<sub>2</sub>/MMBTU

The first set of available calculations is for 1996.

**1999**

Data not available

	1991	1992	1993	1994	1995	1996	1997	1998	1999
Project Size: Vehicle Miles Traveled						3,674,500	1,473,572	1,355,833	
Reported Reductions (Metric Tons CO <sub>2</sub> ):						687.6	285.8	261.3	

Project Developer: **Tennessee Valley Authority**

Project Name: Alternate Fuel Vehicles

Project Description:

In 1994, TVA had 31 alternate fuel vehicles operating in its transportation fleet. These included 23 sedans fueled by M-85 (a blend of 85% methanol and 15% gasoline), 2 compressed natural gas vans, 5 electric pickup trucks, and one electric van.

In question 4, the alternate fuel type listed as "ZZ" is the M-85.

Project results for 1995, 1996, 1997, 1998 and 1999 are not reported, as data were not available.

Estimation Method:

The direct emissions shown in Part 3 are the emissions used to compute the reported emissions reductions. These are the total emissions from the TVA transportation fleet. The actual CO<sub>2</sub> emissions were determined from the fuel consumed and the fuel emissions factor from Appendix B. See the previous project, Transportation Fleet Fuel Efficiency Improvements.

The CO<sub>2</sub> reductions as a result of alternate fuel vehicle (AFV) operation is the net difference between the modified reference case CO<sub>2</sub> emissions and the actual emissions from the AFVs. The modified reference case emissions are the emissions that would have occurred had the miles driven by the AFVs been driven by the conventional fleet. The modified reference case emissions were determined from the actual AFV miles traveled, the average miles per gallon for the comparable conventional vehicles, the heating value of gasoline (125,100 BTU/Gal), and the gasoline emissions factor from Appendix B (157 lb CO<sub>2</sub>/MM BTU). It was assumed that the electric and CNG vehicles displaced emissions from the conventional 4X2 pickup fleet and the M-85 vehicles displaced emissions from the conventional sedan fleet.

The actual emissions for the CNG and M-85 AFVs were determined from the fuel usage, the heating value of the fuel, and the fuel emissions factor. The heating value for CNG is 1000 BTU/Ft<sup>3</sup> and for M-85 is 73,590 BTU/Gal. The emissions factor for CNG is 120 lbs CO<sub>2</sub>/MM BTU and 146 lbs CO<sub>2</sub>/MM BTU for M-85.

To determine the actual emissions for the electric vehicles it was assumed that the energy used to charge the vehicles was generated by the TVA coal fired system. The emissions associated with the charging was determined from the KWH used, the average coal fired system heat rate, and the coal emissions factor from Appendix B.

The following table summarizes the operation of the AFVs and the resulting effect on CO<sub>2</sub> emissions for 1994. In this table, negative changes, i.e. reductions, are shown in parentheses.

Alt. Fuel	Change in Miles Driven	Alt. Fuel Used	Conv. Vehicle MPG	Change in Gasoline Gallons	Conv. Vehicle CO <sub>2</sub> Tons	Heat Rate BTU/Kwh	Fossil Fuel CO <sub>2</sub> Tons	Change In CO <sub>2</sub> Emission Tons
M-85	14,258	544 Gal	29.8	(478)	(4.7)	-----	2.9	(1.8)
CNG	1,301	25,000 CF	15.5	(84)	(0.8)	-----	1.5	0.7
Elec.	4,201	1,360 Kwh	21.2	(198)	(1.9)	10,047	1.4	(0.5)
Total	19,760			(760)	(7.5)		5.8	(1.6)

	1991	1992	1993	1994	1995	1996	1997	1998	1999
Project Size: Vehicle Miles Traveled				19,760					
Reported Reductions (Metric Tons CO <sub>2</sub> )				1.5					



Project Developer: **TXU**

Project Name: Alternative Fuel Vehicle Program

Project Description:

TXU operates a fleet of alternatively fueled vehicles (chiefly compressed natural gas). This is the fourth year that the Company has included the carbon dioxide emissions reductions from these vehicles in the Climate Challenge Program.

Estimation Method:

Estimates of the reduction of carbon dioxide from operating alternative fueled vehicles were based on the assumption that equivalent miles would have been driven by gasoline powered vehicles. First, the equivalent tons of carbon dioxide from gasoline vehicles were calculated then this quantity was subtracted from the equivalent tons of carbon dioxide generated from alternative fueled vehicles driving the same number of miles. Emission factors for carbon dioxide per fuel type were taken from Tables 4.2 and 4.3, page 4.19 of the Sector-Specific Issues and Reporting Methodologies, Volume II, part 4- Transportation Sector, October 1994. The DOT CAFE Standard of 27.5 mpg divided by 1.15 was used as the miles per gallon of gasoline and 20 mpg divided by 1.15 for propane was estimated.

The emission factors used for this project are listed:

	Direct	Indirect	Total
Gasoline	8,900	2,100	11,000 g/gal
Propane	5,747	483	6,230 g/gal
Methane	60.5	3.9	64.4 g/ft3

	1991	1992	1993	1994	1995	1996	1997	1998	1999
Project Size: Vehicles						323	300	300	266
Reported Reductions (Metric Tons CO <sub>2</sub> )						592.4	483.5	517.1	445.4

### Project Description:

Estimation Method:

[illegible]

Project Developer: **Western Resources, Inc.**

Project Name: Conversion of Company Fleet Vehicles to Alternative Fuels

Project Description:

Conversion of Company Fleet Vehicles to Alternative Fuel Vehicles - Western Resources has converted company fleet vehicles to compressed natural gas (CNG) or dual fuel (CNG and gas/diesel) vehicles. These alternative fuel vehicles emit approximately 1/2 of the equivalent CO<sub>2</sub> emissions as conventional vehicles. Western Resources currently has 5 alternative fuel vehicles (AFV).

Estimation Method:

(1) Western Resources has converted the following fleet vehicles to alternative fuel vehicles:

1991 CNG Vehicles - 0	1991 Dual Fuel Vehicles - 3
1992 CNG Vehicles - 6	1992 Dual Fuel Vehicles - 20
1993 CNG Vehicles - 6	1993 Dual Fuel Vehicles - 15
1994 CNG Vehicles - 9	1994 Dual Fuel Vehicles - 16
1995 CNG Vehicles - 2	1995 Dual Fuel Vehicles - 22
1996 CNG Vehicles - 2	1996 Dual Fuel Vehicles - 22
1997 CNG Vehicles - 2	1997 Dual Fuel Vehicles - 22 (Jan. to Nov.1997)
11/97 CNG Vehicles - 1	1997 Dual Fuel Vehicles - 4 (December 1997)
1998 CNG Vehicles - 1	1998 Dual Fuel Vehicles - 4
1999 CNG Vehicles - 1	1999 Dual Fuel Vehicles - 4

In November 1997, 19 AFVs were transferred to OneOak, with the remaining 5 APVs being retained by Western Resources (1 CNG and 4 Dual Fuel).

(2) Based on information available from Argonne National Laboratories studies, the overall equivalent CO<sub>2</sub> emissions reduction of a CNG vehicle compared to a conventional vehicle is approximately 1.05 metric tons annually. This includes the net effect of an equivalent reduction in N<sub>2</sub>O emissions and an equivalent increase in CH<sub>4</sub> emissions. This emissions data was also summarized in the 1605(b) transportation guidelines. It is assumed company vehicles are used for 10,000 vehicle miles traveled (VMT) per year on average.

(3) Assuming dual fuel vehicles are operated on CNG 75% of the time and therefore, reduce equivalent emissions by 75% of a dedicated CNG vehicle, the equivalent CO<sub>2</sub> emissions avoided are estimated as:

1991 Equiv. CO<sub>2</sub> Emissions Avoided = 2 metric tons

1992 Equiv. CO<sub>2</sub> Emissions Avoided = 22 metric tons

1993 Equiv. CO<sub>2</sub> Emissions Avoided = 18.1 metric tons

1994 Equiv. CO<sub>2</sub> Emissions Avoided = 22.1 metric tons

1995 Equiv. CO<sub>2</sub> Emissions Avoided = 19.4 metric tons

1996 Equiv. CO<sub>2</sub> Emissions Avoided = 19.4 metric tons

1997 Equiv. CO<sub>2</sub> Emissions Avoided = 18.2 metric tons

1998 Equiv. CO<sub>2</sub> Emissions Avoided = 4.2 metric tons

1999 Equiv. CO<sub>2</sub> Emissions Avoided = 4.2 metric tons

(4) Future CO<sub>2</sub> emissions avoided were based on a continuation of the 4.2 metric tons in the future for the two years covering 1999-2000.

(5) No indirect emissions impacts were estimated.

	<b>1991</b>	<b>1992</b>	<b>1993</b>	<b>1994</b>	<b>1995</b>	<b>1996</b>	<b>1997</b>	<b>1998</b>	<b>1999</b>
Project Size: Vehicles	2.25	21	17.3	21	18.5	18.5	17.3	5	5
Reported Reductions (Metric Tons CO <sub>2</sub> ):	2.0	22.0	18.1	22.1	19.4	19.4	18.2	4.2	4.2

Project Developer: **Wisconsin Electric Power Co.**  
 Project Name: Vehicle conversion to dual fuel capability  
 Project Description:

Conversion of gasoline-fueled vehicles to dual fuel capability (gasoline and Compressed Natural Gas or CNG) reduces CO<sub>2</sub> emissions while the vehicle is using CNG. WE also has a Vehicle CNG Program in which they provide technical assistance to customers wishing to utilize CNG vehicles. Assistance includes: an assessment of how clean fuel legislation and requirements affect the customers business; identification of available technology; determination of the suitability of the customers fleet for conversion; calculation of the cost of the conversion; determination of operating cost savings; determination of fueling station requirements; calculation of payback; and acquisition of bids from conversion equipment vendors. WE will assist in facilitating cooperation between groups who may wish to share the cost of refueling equipment. WE also has a custom spreadsheet to evaluate rebate incentives for larger fleets. In addition, WE provides incentives to encourage conversion of customers vehicles and WE employees personal vehicles to CNG. These incentives include a rebate of \$500 or \$0.50 per annual therm, whichever is greater, for each vehicle converted up to two vehicles; available financing (at 0% interest for WE employees); and fueling availability at WE fueling stations. System CO<sub>2</sub> emission reductions due to CNG vehicle conversions in baseline years (in tons):

Year	1987	1988	1989	1990
Tons	94	89	55	49

Estimation Method:

Data Source: Form 1605(b) instruction manual

CO<sub>2</sub> Emission Reductions = CO<sub>2</sub> (gasoline saved) - CO<sub>2</sub> (natural gas used) = (gal. gasoline \* emission factor) - ( mscf \* emission factor )  
 Direct reductions are related to conversion of company vehicles. Indirect reductions are related to conversion of customer vehicles.

NOTE: 1998 and revised 1997 values reflect the unavailability of CNG conversion kits for WE fleet vehicles plus an error in calculation that had resulted in understating total 1997 CO<sub>2</sub> emission reductions by about 700 st. Emission rates were revised for 1995 through 1998 in 10/99.

	1991	1992	1993	1994	1995	1996	1997	1998	1999
Project Size: Vehicles	47	130	224	335	524	538	652	828	688
Reported Reductions (Metric Tons CO <sub>2</sub> ):	175.0	598.0	1,118.0	1,505.9	2,360.1	2,417.3	2,926.7	3,646.0	3,076.3